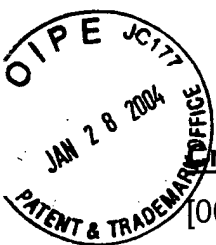


**SUBSTITUTE SPECIFICATION UNDER 37 CFR 1.125**  
**"FLOOR DISPLAY SYSTEM WITH VARIABLE IMAGE ORIENTATION"**  
**INVENTORS BLUM ET AL.**  
**U.S. APP. SER. NO. 10/682,435, FILED OCT. 10, 2003**  
**"CLEAN" VERSION**



## FLOOR DISPLAY SYSTEM WITH VARIABLE IMAGE ORIENTATION

### Cross-reference to related applications

[0001] This application claims the benefit under 35 U.S.C. § 119(e) of U.S. provisional applications identified as follows: application serial no. 60/418,626, filed October 12, 2002; application serial no. 60/428,387, filed November 21, 2002; and application serial no. 60/429,044, filed November 23, 2002. Moreover, this application is a continuation-in-part of application serial no. 10/438,923, filed May 16, 2003. Application serial no. 10/438,923 is a continuation-in-part of co-pending application serial no. 10/285,639, filed November 1, 2002, which is a continuation of application serial no. 10/137,357, filed May 3, 2002, and issued as U.S. Patent No. 6,507,285 on January 14, 2003. Application serial no. 10/137,357 is a continuation of application serial no. 09/767,846, filed January 24, 2001, and issued as U.S. Patent No. 6,417,778 on July 9, 2002. Application serial no. 09/767,846 is a continuation of application serial no. 09/418,752, filed October 15, 1999, and now abandoned. Application serial no. 09/418,752 is a continuation-in-part of application serial no. 09/304,051, filed May 4, 1999, and issued as U.S. Patent No. 6,219,876 on April 24, 2001. Each of the above-identified applications is fully incorporated herein by reference.

### Background

[0002] Advertising and other kinds of messaging are typically presented in forms that use "vertical space": that is, billboards, walls, ceiling-mounted displays, and the like. On the other hand, one kind of space that has great potential for advertising and messaging, but has been largely overlooked, is floor space, which may be characterized as "horizontal space."

[0003] There have been efforts to exploit floor space for advertising. Adhesive (i.e., "stick-on") floor decals are known. Such decals may include a colorful image and convey some kind of advertising message, such as "Drink Coke". Such an advertising medium is limited, however, by the fact that the message is static and not easily changed. On the other hand, U.S. Patent 6,417,778, which is fully incorporated herein by reference, describes a modifiable electronic display associated with a floor that

enables images and text to be easily changed, allowing an advertising message to be quickly adaptable and efficiently targeted toward desired customers.

[0004] However, there remain challenges to effectively and efficiently communicating to an audience by displayed visual advertising or messaging on the floor or ground. Among these challenges is how to orient the content of a display for easy viewing and comprehension. In vertical space, by contrast, challenges relating to image orientation are not usually presented. For example, when a person views a computer monitor or television set, the image displayed is almost always "right side up" from the perspective of the viewer, since people, for the most part, orient themselves with their feet on the ground and their heads in the air. Thus, similarly, images in advertising and messaging in vertical space are almost always right side up with respect to a viewer.

[0005] On the other hand, when an image is in horizontal space, problems relating to the orientation of the image may be presented. For example, an image that is on a floor and co-planar with the floor may be approached or viewed from any number of different directions. Depending on the direction of approach of a viewer, the image may be right side up, upside down, sideways, or otherwise skewed in any direction from the perspective of the viewer. More specifically, suppose an image on the floor is oriented to be easily seen and understood by viewers walking north (e.g., right side up with respect to these viewers). This image will be upside down and therefore largely unintelligible to viewers walking south. Similarly, suppose an image on the floor is oriented to be right side up to viewers walking west -- the same image will be upside down to viewers walking east.

[0006] Such considerations may be further complicated by observing how differences in language affect image presentation. For example, although English text is read from left to right and top to bottom, in that order, in Asian languages such as Japanese, text is read from top to bottom in columns in a left-to-right progression of columns. In Israel text is read from right to left.

### **Brief Description of the Drawings**

[0007] FIGs. 1 and 2A-2D show a floor display system according to embodiments of the present invention;

[0008] FIGs. 3, 4, 5A-5C, 6A-6B, and 7 illustrate variable image orientation according to embodiments of the present invention;

[0009] FIGs. 8A-8D illustrate various arrangements for configuring a floor display system according to embodiments of the present invention with selected content;

[0010] FIGs. 9 and 10 show various interactivity devices which may be associated with a floor display system according to embodiments of the present invention;

[0011] FIG. 11 shows a layer of material comprising a thin diffractive prism according to embodiments of the present invention;

[0012] FIGs. 12A and 12B show a protective cover according to embodiments of the present invention;

[0013] FIGs. 13A and 13B show a protective sheet according to embodiments of the present invention;

[0014] FIGs. 14 and 15 show an alarm system according to embodiments of the present invention;

[0015] FIGs. 16-18 show components and assembly of a floor display system according to embodiments of the present invention;

[0016] FIGs. 19A-19D show a track-and-trench system according to embodiments of the present invention;

[0017] FIGs. 20A-20E illustrate a positioning mechanism system according to embodiments of the present invention; and

[0018] FIGs. 21A-21C show a lightweight, flexible electronic display device according to embodiments of the present invention.

### **Detailed Description**

[0019] Embodiments of the present invention relate to a floor display system with, among other features, variable image orientation. More specifically, an image displayed by the floor display system may be oriented and/or re-oriented depending on the perspective of viewers, in order to make the image more easily seen and understood. To orient and/or re-orient the image, the image may be rotated or otherwise moved or shifted.

[0020] The floor display system may be arranged in a public place, such as a commercial establishment or other public building, and be configured to display electronically modifiable arbitrary content, such as advertising or other informational content. For example, the floor display system may be arranged near shelving storing products for sale, and display advertising and promotional content relating to the products. In addition to variable image orientation, the floor display system may include the features of: networked data distribution and management; interactivity; image-enhancing optics; controlled audio; a protective covering; an anti-slip feature; fragrance technology; theft prevention; deployment in a track-and-trench system; specialized positioning mechanisms; and lightweight, flexible implementations. These and other aspects of embodiments of the present invention are discussed in more detail below.

[0021] As noted above, U.S. 6,417,778 discloses a system for electronically conveying information via a floor display. More specifically, the floor display may incorporate a modifiable electronic display surface presenting for example, a liquid crystal display. The display could be connected to a computer and a computer generated image could be displayed on the display. Thus, the image displayed on the display could be modified by generating a different computer image and displaying that computer image on the display. The display could be associated with a base portion of a floor covering, such as included within a recess thereof, or could be included on a bottom surface, facing upward, of an insert portion of the floor covering. Alternatively, the display could be integrally formed with either of the base portion or the insert portion. The modifiable display could utilize a plurality of different graphics that can be displayed in any of a variety of manners on the display. For example, the graphics could be displayed in a generally fixed position on the display or could scroll across the display, with both exemplary methodologies displaying multiple graphics either individually or in combination.

[0022] Other alternatives for modifying graphics displayed on the floor covering include using light emitting polymers to create, and thus change, the graphics. The light emitting polymers can be either applied to, attached to, or woven into the floor covering. The light emitting polymers may be utilized on any portion of floor covering, for example, on either the base portion or the insert portion, or on any other portion of the different

embodiments for the floor covering. Light emitting polymers are known and described in U.S. Patents 5,945,502, 5,869,350, and 5,571,626, which are incorporated herein by reference in their entirety.

[0023] Other options for a display are to use electronic ink or electric paper. Electric paper is available from Xerox and is described in U.S. Patents 5,723,204, 5,604,027, 4,126,854, and 4,143,103, which are incorporated herein by reference in their entirety. Electric paper employs thousands of tiny, electrically charged beads, called Gyricon, each about the width of a human hair, to create pixels. The two-tone beads are embedded inside a liquid-filled plastic sheeting that forms the surface of the paper. Each bead, half-black, half-white, gyrates in response to an electric field. Whether the beads are black- or white-side up determines the image. Because there's no need to refresh the image, and because the screen isn't backlit, electric paper uses only a fraction of the power used by conventional electronic displays. Electromagnetic styluses and printer-like devices can be used for getting images onto the paper.

[0024] Electronic ink is available from E Ink Corp., at 45 Spinelli Pl., Cambridge, MA 02138. Electronic ink uses a microencapsulated micromechanical display system. Tiny microcapsules are captured between two sheets of plastic to create pixels.

Alternatively, the capsules may be sprayed on a surface. The result is a flexible display material. The tiny capsules are transparent and contain a mixture of dark ink and white paint chips. An electric charge is passed through the capsules. Depending on the electrostatic charge, the paint chips float at the top or rest on the bottom of each capsule. When the paint chips float at the top, the surface appears white. When they rest at the bottom, and thus under the ink, the surface appears black. Each of the two states is stable: black or white. A transparent electromagnetic grid laid over the sheet's surface controls the shape of the image. The display may be wirelessly connected to, for example, a computer and thus, the World Wide Web by utilizing, for example, a Motorola paging system. Text on all displays, if multiple displays are used, can be changed at once by a single editor, through a Web page.

[0025] According to embodiments of the present invention, additional or alternative technologies to those described above may be used to implement a floor display system. "Floor" as used herein means floor, ground, or any surfaces thereof including

concrete, asphalt, carpeting, wood, linoleum, tile, rubber, vinyl and the like. A floor display system 100 according to embodiments of the present invention is shown in Fig. 1. The floor display system 100 includes an electronic display device 101 associated with a floor covering 102. More specifically, the display device 101 may be at least partly connected to, supported by, received within or otherwise associated with the floor covering 102. The floor covering 102 and associated electronic display device 101 may take many structural forms and be constructed from various types of materials, and are not limited to the specific forms illustrated herein. In embodiments, the floor covering 102 and electronic display device 101 are designed to be used in places where there is foot traffic or other (for example, wheeled shopping cart) traffic. Accordingly, the floor covering and electronic display device may be sturdy and durable enough that they may be repeatedly stepped on, walked over, or have a wheeled shopping cart or other rolling or sliding object traverse them, with negligible adverse effect on the floor covering and display device. The electronic display device may have, for example, a sturdy protective covering that is transparent or semi-transparent to allow the electronic display device to be viewed therethrough, and that protects the electronic display device from damage associated with foot or other traffic, such as scratches, cracks, chips, tears, or damage caused by environmental dirt. The floor covering 102 may be affixed to a floor or may be portable so that it can be easily moved to different places.

[0026] Figs. 2A and 2B are a top or plan view, and a side orthogonal or elevation view, respectively, of the floor covering 102. As shown in Figs. 2A and 2B, the floor covering 102 could comprise at least one inclined surface. More specifically, the floor covering 102 could comprise a plurality of inclined surfaces 212, 213, 214 and 215 that slope downward and away from a top surface 200 (which could be the surface of a protective covering of the display device 101, as described above) so that the entire perimeter of the floor covering presents an inclined surface to a person approaching the floor covering. Such a structure may make the floor covering easier to cross over, either by a person walking over the floor covering, or by a wheeled shopping cart, for example, if the floor covering is placed in the aisles of a commercial establishment. According to embodiments, at least a portion of the display device 101 could be arranged to be co-planar with one or more of the inclined surfaces of the floor covering.

This could make a display of the display device easier to view for a person at a distance from or approaching the floor covering, since the display would be slightly elevated.

[0027] FIGs. 2C and 2D illustrate that embodiments of the invention may further comprise a flexible or compressible border member 220. The border member 220 may be arranged to abut edges of the inclined surfaces 212, 213, 214 and 215. For example, as shown in cross-sectional view FIG. 2D, the border member 1430 may abut an edge 221 of inclined surface 215. By providing a yielding surface, the border member may cause a less abrupt transition from the floor to the floor covering 102 to be perceived by a person traversing the floor covering. The border member could be made from material such as, by way of example only, metal, wood, plastic, natural rubber, silicon rubber, foam rubber, or urethanes.

[0028] Referring now to Fig. 1, the electronic display device 101 associated with the floor covering 102 may be configured to electronically display graphical images and alphanumeric data in either a static (not moving or changing) or dynamic (e.g., scrolling or otherwise moving or changing) format. More specifically, the electronic display device 101 may be coupled by wired or wireless means to a controller 103 and modifiable via the controller 103 to display any content chosen by a user. For example, as shown in Fig. 1, the electronic display device 101 may be coupled to the controller 103 via a display driver circuit such as a video graphics adapter card 105. The controller 103 may include any kind of electronic logic circuit: for example, a general microprocessor configurable with software, or an ASIC (application specific integrated circuit). The driver 105 of the electronic display device may be integrated with the controller 103 or built into an ASIC. The controller may also be in the form of a single board computer with a processor and memory and with one or more display driving circuits built onto the board, as well as wireless components for communicating with the outside world or for loading data into memory.

[0029] The controller may be coupled to a storage medium 104, which could be any form of medium suitable for storing digital data, including RAM (random access memory), ROM (read-only memory), flash or other non-volatile solid-state electronic storage, EEPROM (electronically erasable and programmable read only memory), or magnetic and/or optical disk storage. The storage medium 104 may store, for example,



control software for execution by the controller 103 and video content of choice for display, under the control of the control software, on the electronic display 101. A user interface (not shown), such as a personal computer with a display monitor and keyboard, may be coupled to the controller to enable configuration of the controller with specific user input, such as specific control programs to produce specific displays and/or audio output. An audio device 111, such as a loudspeaker, may further be coupled to the controller 103 via a sound card 110. The audio device 111 may output audio content of choice, stored in the storage medium 104, under the control of the controller 103. Components of the floor display system 100 may be powered by a power supply 114. The floor display system may further comprise a sensing device 113 to provide for a variety of interactive applications of the floor display system, as described in more detail below. The sensing device 113 could be coupled to the controller 113 and provide signals thereto. The connection of the sensing device to the controller could be wired or wireless.

[0030] Data may be stored in the storage medium 104 using, for example, a data port 106 coupled to a common system bus. The bus could be, by way of example only, a USB (Universal Serial Bus). The floor display system may further comprise a wireless port 107 implemented, for example, using a wireless WAN/LAN card. Through the wireless port 107, the floor display system 100 may be coupled to and communicate with a network 125. The network could be any kind of network, including a wide area network (WAN) such as the Internet, or a local area network (LAN) including, for example, other floor display systems. Through the network 125, the floor display system 100 may be coupled, for example, via a wireless communication device 112, to a server computer 108 of the network. The server computer 108 may be coupled to a database 109. The database 109 may store information relevant to operation of the floor display system 100. For example, the database may contain video and audio content or control software that is downloadable to the storage medium 104 of the floor display system. Thus, the floor display system 100 may be remotely controllable. However, the floor display system 100 need not be networked, and could be controlled locally by, for example, downloading content and control software locally via data port

106. Also, while wireless communication methods and systems are illustrated in Fig. 1, wired systems could also be used, or could be combined with wireless systems.

[0031] Display technologies that may be utilized in embodiments of the present invention, in addition to those described earlier, include: liquid crystal displays (LCDs), light-emitting diodes (LEDs), organic light-emitting diodes (OLEDs), electroluminescent (EL) displays, plasma display panels (PDPs), field emission displays (FEDs) including printable field emitters, ferroelectric displays, polymeric light emitting diodes (PLEDs), light emitting polymers (LEPs), electronic paper, and light-emitting ceramic or other light-emitting inorganic materials. Other display technologies that may be utilized in embodiments include optical fiber technology, where a remote image is formed electronically and transmitted utilizing a light guiding source to fiber arrays or bundles. The remote image light source could be internal or external to the floor covering. Other contemplated display technologies include holographic displays. In this technique, either a white-light or laser hologram may generated either internally or externally to the floor covering 102, and focused by a lens, possibly a Fresnel lens, to make it visible to persons viewing the display 101 at an acute angle.

[0032] As noted above, the electronic display device 101 is capable of displaying at least alphanumeric data and graphic images. The content may include alphanumeric data alone, graphic images (e.g., pictures) alone, or combinations of the two, either static, moving, or both static and moving, in accordance with selected video content. Moving alphanumeric data and images may, for example, be scrolled. The alphanumeric data and graphic images could be black and white or in full color. Further, the display device 101 may include more than one distinct display: that is, the display area of the display device could be partitioned with respect to content. For example, the display area could include two or more different "windows," each displaying different content. Such a partitioning of displays is well known, for example, in "split-screen" TV and through the widespread use of various graphics software applications, including the ubiquitous "Windows" software by Microsoft®.

[0033] Various digital video file formats could be used to generate images on the electronic display device 101, including MPEG (Moving Picture Experts Group), DVD (digital versatile disc) or digital video disc, and Flash. Further, conventional video

content used, for example, in network television, could be converted into digital video content for display on an electronic display device 101 according to embodiments of the present invention. One such converting process involves taking conventional NTSC (National Television Systems Committee) video from a tape, and capturing it on a computer through a video capture card. An example of this type of card is a Targa 2000 RTX board. Once captured, the video may be compressed into a file with a format that can be played by digital equipment. The file could be saved in MPEG 1 or MPEG 2 format, for example.

[0034] According to embodiments, components of the floor display system 100 as described above could be housed completely internally to the floor covering 102, completely externally to the floor covering 102, or some components could be internal to the floor covering 102, while others are external.

### **Variable Image Orientation**

[0035] FIG. 3 illustrates a floor display system with variable image orientation according to embodiments of the present invention. "Image" means anything capable of visual representation, including pictures, designs, text, numbers, etc., either solely or in any combination, in either static or dynamic formats or combinations thereof. In FIG. 3, a floor display system 100 is shown with versions 320, 335 of the same image, where each version is oriented for viewing from a respective different direction. More specifically, an image 335 may be substantially "right side up" from a perspective of a first viewer, while image 320 may be substantially "upside down" from the perspective of the first viewer. On the other hand, from a perspective of a second viewer, image 335 may be substantially "upside down" while image 320 may be substantially "right side up." In a floor display system as shown in FIG. 3, an electronic display device 101 of the system may include a plurality of separate display modules or panels 310, 315, 325, 330 associated with a floor covering 102. Each panel may independently incorporate any of the display technologies described above. Two or more panels may be configurable to display a composite image: for example, respective displays on panels 325 and 330 form a composite image 335. Moreover, each of the separate panels may be configurable to display an image independently. "Independently" in this context

means not as part of a composite image. Further, each panel may be configurable to display an image with a different orientation from an image on another panel.

[0036] In some applications it may be advantageous for the viewer to only see the image from the individual panels directly in front of him. In such applications, certain standard LCD displays having a very shallow viewing angle may work well. That is, by appropriately orienting display panels 310, 315, 325, 330 incorporating such standard LCD technology, it may be possible to cause a corresponding display to be substantially visible when viewed from one direction, but substantially not visible when viewed from another. For example, depending on the LCD technology used, a viewer approaching or standing near an edge 327 of the panels may be able to clearly see an image on panels 310 and 315, but not be able to clearly see an image on panels 325 and 330. Similarly, a viewer approaching or standing near an edge 329 of the panels may be able to clearly see an image on panels 325 and 330, but not be able to clearly see an image on panels 310 and 315. Selectively orienting the panels in this way may prevent a viewer approaching the floor display system from seeing and therefore struggling to understand an image that would appear upside down or skewed to him.

[0037] FIG. 4 shows another possible application of a multi-panel display as discussed above. As shown in FIG. 4, each panel could be configured to display an image independently of the other panels (as opposed to forming a composite image using two or more panels). In the example of FIG. 4, each panel 310, 315, 325, 330 shows a respective different complete image 410, 415, 425, 430, where each image has an orientation different from at least one of the other images. For example, the respective orientations of each image may be selected to be best suited for viewing from a respective different direction. Such a feature could be used, for example, to display different messages to people approaching from respective different directions. Generally, embodiments of the invention as illustrated in FIGs. 3 and 4 may be particularly advantageous when arranged in a location where people walk principally in two mutually opposite directions, for example, in the aisle of a grocery store, at the top or bottom of a flight of stairs, or in entrance/exit ways. It is noted that a multi-panel display according to embodiments of the present invention is not limited to four panels; more or fewer panels are possible.

[0038] Further alternatives according to embodiments of the present invention are illustrated in FIG. 5A-5C. As shown in FIGs. 5A-5C, the floor display system 100 could comprise an electronically rotatable and translatable (i.e., movable or shiftable) image 520. The floor display system could further comprise a plurality of proximity detectors 530, 540, 550, 560, for example, included in a sensing device 113. Based on signals from the proximity detectors, the rotatable and translatable image could be rotated and/or translated to a desired orientation for viewing by a viewer, based on criteria such as how close the viewer is to the floor display system.

[0039] More specifically, the proximity detectors 530, 540, 550, 560 could be, for example, mounted in, attached to, or otherwise associated with edges of the floor covering 102. For example, the proximity detectors 530, 540, 550, 560 could respectively be associated with the inclined surfaces 212, 213, 214 and 215 of the floor covering. The proximity detectors could be used to determine an orientation of a given image 520 at a given time, depending on the proximity of viewers. For example, the proximity detectors could be coupled to the controller 103 of the floor display system and send signals to the controller. Based on information in the signals received from the proximity detectors, it could be determined by the controller that a first viewer 580 is closer to, say, proximity detector 550 than a second viewer 590 is to proximity detector 540. The determination by the controller could be made, for example, by executing a suitable hardware and/or software algorithm. Under the conditions shown in FIG. 5A, for example, the controller could cause image 520 to be rotated and/or translated so that it was right side up from the perspective of viewer 580. On the other hand, as shown in FIG. 5B, it could be determined based on inputs from the proximity detectors that viewer 590 was closer to proximity detector 540 than viewer 580 was to proximity detector 550. Under these conditions, image 520 could be rotated and/or translated so that it was right side up from the perspective of viewer 590. Similarly, as shown in FIG. 5C, it could be determined based on inputs from the proximity detectors that viewer 595 was closer to proximity detector 530 than viewer 590 was to proximity detector 540. Under these conditions, image 520 could be rotated and/or translated so that it was right side up from the perspective of viewer 595.

[0040] Techniques are known for performing image rotation and/or translation as described above. For example, many currently-available electronic display drivers (such as video graphics adapter card 105) and electronic display devices 101 support image rotation and/or translation with software that is specifically designed for such operations. Based on input signals from the proximity detectors, as noted earlier, a controller 103 could execute decision software to implement, for example, decision trees to decide which of a plurality of viewers is closest to, and to which edge of, the floor display system. The controller could then execute corresponding rotation and/or translation software to rotate and/or translate a displayed image accordingly. It is noted that image rotation and/or translation need not occur in 90-degree increments as shown in FIGs. 5A-5C; finer increments in rotation are possible, down to fractions of a degree.

[0041] While image rotation and/or translation software is one possibility for implementation, another possibility could be to store images in a plurality of different, fixed orientations, and to select a given image from among the stored images for display depending on a proximity decision. Moreover, proximity might not be the only basis for selecting a particular image orientation; other bases are possible. For example, the image might be configured to cycle through a plurality of different orientations periodically. There could be a default orientation for the image if no viewer is sufficiently near, or if a decision on proximity cannot be reached. Embodiments of the invention could further include a "screen-saver" mode, and either start or stop video output based on the proximity of persons.

[0042] Proximity detectors could be implemented in a variety of forms, including, for example: ultrasonic detectors, thermal detectors, motion detectors, IR (infrared) range finders, electric eyes, cameras, charge coupled devices (CCDs) or other imaging systems.

[0043] It is further noted that, as shown in FIG. 5A, an outline 577 is intended to represent either part of an electronically-generated graphic, or a actual physical edge of an electronic display device 101 of the floor display system that has a substantially circular form, as opposed to a substantially square or rectangular form as shown in previous figures. A substantially circular electronic display device according to embodiments of the present invention could be mechanically rotated to re-orient images

based on signals from proximity sensors. On the other hand, FIGs. 6A and 6B illustrate electronic (e.g., software-driven) image rotation and/or translation where the electronic display device of the floor display system comprises multiple modules or panels in a substantially square or rectangular configuration as described earlier.

[0044] FIG. 7 illustrates that proximity detection need not necessarily be performed by proximity detectors located in or on the floor covering 102. Instead, for example, proximity detectors could be located in, on, or be otherwise associated with an object near the floor display system 100. FIG. 7 shows proximity detectors 715, 720, and 730 located on shelving 710 adjacent a floor display system 100. Based on signals received from proximity detectors 715, 720 and 730, a controller 103 of the floor display system could determine which of a plurality of viewers was closest, and orient a rotatable/translatable image 720 accordingly. This determination could be made, for example, based on known distances of respective detectors from the floor display system. Proximity detectors could also be placed in ceilings or suspended from ceilings, for example on tracks.

#### **Data Distribution and Management:**

[0045] It is contemplated that floor display systems according to embodiments of the present invention may be deployed in many types of public buildings, including commercial establishments (e.g., markets, stores). In an individual building, there could be a plurality of floor display systems deployed. The plurality of floor display systems could be used, for example, to announce sales and prices, provide product descriptions, direct customers to specific locations within a commercial establishment, and the like. Thus, it could be advantageous to control floor display systems, individually or in groups, to generate particular video/audio output based on their locations. More specifically, the video/audio content output by a given floor display system could, for example, relate to nearby products, such as products on adjacent shelving. Accordingly, embodiments of present invention relate to configuring floor display systems to generate particular video/audio output, as described below.

#### **Direct-link Download**

[0046] Referring to FIG. 8A, a user may locally configure a floor display system 100 by physically connecting a configuring device 800 such as a hand-held controller/storage device (CSD) to the floor display system 100. The connection may be, e.g., via a direct link 801, such as a cable link to, e.g., a data port 106 of the floor display system. The user may then download selected video/audio content and/or control software from the device 800 into a storage medium 104 of the floor display system. What data is downloaded to a floor display system may depend, for example, on where the floor display system is located, and thus what content might be relevant. The video/audio content downloaded may be changed by downloading new video/audio content by the same method.

#### Local Area Network (LAN) Download

[0047] Referring to FIG. 8B, a user may remotely configure a floor display system, for example, as follows: the user may connect a device 800 to a computer 108 (e.g., a network server; see FIG. 1) in a building; this connection could be implemented, for example, wirelessly via IRDA (Infrared Data Association), or via a wired USB link. The network sever 108 may in turn be connected, by wired or wireless connections (e.g., using a LAN 125 and Ethernet), to a plurality of floor display systems 100 in the building. Video/audio content and/or control software may then be downloaded from the device 800 to the network server 108, and from the network server, to each connected floor display system 100. Data downloaded to a first floor display system may be different from data that is downloaded to a second floor display system, depending, for example, on the respective locations of the first and second floor display systems. The device 800 could be, for example, a CSD, a personal or laptop computer, or the like. Alternatively, the server 108 could be linked to a database 109 containing content and control software, and a user could direct the server 108 to download content and/or control software from the database 109 to the floor display systems.

#### Local Area Wireless Download

[0048] Referring to FIG. 8C, according to embodiments of the invention, a user need not connect to a network server computer as described above. Instead, the user need



only be in the vicinity of the plurality of floor display systems to be configured, and remotely configure the floor display systems wirelessly from as much as 100 feet away or more. As shown in FIG. 8C, the user could, for example, have a device 800 such as a laptop computer or CSD equipped with a short-range wireless transmitter that can send a wireless signal 802 to communicate with each floor display system 100 in a commercial establishment via, for example, CDMA (code division multiple access) or other similar communication protocol. In this way, content and/or control software can be wirelessly downloaded to each floor display system without going through a network. Alternatively, the same short-range wireless transmission could be used to send data to a network server 108, which would then distribute the data to each floor display system.

#### Wide Area Network (WAN) Download

[0049] Referring to FIG. 8D, according to embodiments of the invention, remote communication with and configuring of a plurality of floor display systems in multiple different buildings, such as commercial establishments, is possible. This may be accomplished, for example, with a WAN (wide area network) configuration. More specifically, as shown in Fig. 8D, a central control location 803 may be linked via a wired or wireless connection to the Internet or some other wired or wireless (e.g., satellite) WAN 804 to a LAN 125 associated with each establishment. Each LAN 125 may in turn be linked by wire or wireless means to a plurality of floor display systems 100 arranged in the establishment. Video/audio content and/or control software may then be downloaded from the central control location 803 to each LAN, which may then transmit the video/audio content and/or control software to the plurality of floor display systems. Since, as discussed above, it may be desirable to have respective floor display systems in the same establishment generate different video/audio output, each floor display system could have a unique identifier code assigned to it. This identifier code could be provided in a header of the digital data corresponding to the video/audio content and/or control software intended for a particular floor display system. The header information could be used to ensure that each floor display system received the data intended for it.

### Satellite Network Download

[0050] As a variation of the WAN download technique described above, satellite network download could be used where the wide area network is provided via satellite constellation. Here, a satellite may broadcast data point-to-multi-point to receivers (e.g., dish receivers) in each establishment containing floor display systems. The data may then be disseminated via LAN, e.g., to respective floor display systems. Satellite systems such as Motorola's Iridium, Hughes' Direct TV, and Boeing Digital Cinema have already demonstrated such capabilities.

### Floor Display Linked to Point of Sale (POS) System

[0051] A floor display system 100 according to embodiments of the invention may be linked to a POS (point of sale) system of an establishment. A POS system may be used to gather information about consumer preferences. Information about the effectiveness of specific advertising content in generating sales could be gathered, for example, by correlating sales of a given item in an establishment with the timing of given content displayed on a floor display system. This could be accomplished, for example, by electronically cross-referencing sales transactions, at the time they occur, with the scheduling of particular advertising for display on a floor display system. To provide this scheduling information to the POS system, the floor display system could be connected directly to computers or servers of the POS system. Alternatively, a server computer of a LAN, for instance, could control the scheduling of content on the various floor display systems of an establishment, and provide the scheduling information to a server of the POS system so that it could be correlated in "real time," i.e., contemporaneously, with sales transactions. Alternatively, the scheduling information could be correlated with sales records "offline" at a later time.

### Interactivity

[0052] Embodiments of a floor display system according to the present invention may include interactive features, as discussed below.

### Requesting Information

[0053] Embodiments of the present invention may include the capabilities of asking consumers for information and recording the requested information. An illustrative example is shown in FIG. 9. As shown in FIG. 9, a number of interactivity devices providing for interaction with persons may be coupled, via wired or wireless connections (e.g., Bluetooth), to a floor display system 100. The interactivity devices may include, for example, a speech input device 900, such as a microphone, a keyboard or keypad 901 for entering alphanumeric data, a touch-sensitive display screen 902, a card reader 903, a bar code scanner 905, and a coupon dispenser 907. Each of the devices may be arranged at a comfortable level for speaking or typing into, or otherwise handling. The floor display system 100 could include speech recognition software for performing speech recognition processing of utterances directed by a person into the speech input device 900. The floor display system might further include pressure sensors 909 under a top surface of a display area of the floor display system. The pressure sensors 909 could implemented as, for example, thin-film contact switches. Each of the foregoing interactivity devices could be coupled to a controller 103 of the floor display system for sending signals to the controller. The controller could be programmed to perform a desired function depending on the signals received.

[0054] The floor display system 100 and associated interactivity devices may be arranged, for example, in a convenient location in a commercial establishment. The floor display system 100 could generate requests for information, either visually or audibly, to customers passing by. The floor display system could generate the requests when the proximity of persons was sensed by sensing device 113. In the requests for information, the floor display system could, for example, request consumer opinion regarding pricing, product specifications, product preferences, coupons, or any other kind of desired information. The floor display system could prompt a customer to reply, for example, by speaking into the speech input device 900, by keying in information on the keyboard/keypad 901, by pressing certain fields in a display of the touch-sensitive screen 902, by stepping on specified portions of the floor display system to register responses via pressure on the pressure sensors 909, or by any combination of these.

[0055] The floor display system 100 could record customer responses in a storage medium such as storage medium 104. When enough responses had been collected,

the information could be downloaded and analyzed, for example, by brand marketers to determine customer preferences.

[0056] The floor display system 100 could also be configured to respond, either by visual or audio output, to a request from a person, where the request is made either by speaking or by entering data using any of the interactivity devices described above (e.g., keyboard/keypad 901, touch-sensitive screen 902).

[0057] The card reader 903 could be used, for example, to obtain identity information from customers. Such identity information may include, but is not limited to: name, age, history of purchases, frequency of store visits, most commonly purchased items, store credit amount, information pertaining to a store discount, and the like. The identity information could be, for example, magnetically encoded on a card 904 readable by the card reader 903. The card 904 could be, for example, a "smart" card. Smart cards (or electronic cards) are known devices that typically contain an embedded computer chip and are typically the size of a conventional credit or debit card.

[0058] The bar code scanner 905 could be used, for example, to enable a customer to scan a coupon 906. In response, the floor display system could generate a visual and/or audio message concerning the coupon. The message might, for instance, inform the customer that the coupon is still valid, or that it is worth double, or the like. The customer might also be enabled to scan a product at the bar code scanner 905, and receive a coupon in response. A coupon 908 could be printed or otherwise generated, and dispensed by the coupon dispenser 907. The coupon dispenser 907 could include a counter to count how many coupons are dispensed and for what products. This information could be recorded by the floor display system and used by marketers, for example, to gauge consumer reaction to advertisements, prices, and so on.

#### Displaying a Person's Camera Image

[0059] Embodiments of the present invention may include an interactivity device implemented as a camera to capture a person's image and cause it to be displayed on a floor display system. An illustrative example is shown in FIG. 10. A camera 1000 may be mounted near a floor display system 100 on a floor 1050, for example, on shelving 1020. The camera 1000 may be positioned so as to capture an image of a person 1030

walking or standing near the floor display system. The person's image 1060 could, for example, be incorporated into an advertisement 1070 displayed on the floor display system. The person's image could be displayed, for example, as continuous motion video, or in a still image. A "frame-grabber" feature of the camera could be used to create a still image. The still image might be modified, for example, by image editing software, to convey some entertaining message. For example, in the advertisement 1070 of FIG. 10, a milk mustache could be superimposed onto the face of the person.

### **Optics**

[0060] Techniques for enhancing visibility or a visual effect of a display according to embodiments of the invention include the use of prisms. Diffractive or Fresnel prisms are known and are commercially available, for example, under the brand name Reflexite™. Such diffractive prisms may be as thin as a few millimeters or even a fraction of a millimeter. According to embodiments of the present invention, a thin layer of material comprising a diffractive prism may be arranged over an electronic display device of a floor display system. Placing such a diffractive prism over an electronic display device could enable a corresponding display to be more easily visible, particularly along a specific direction. At the same time, because the prism material is thin, the floor display system could remain unobtrusive. FIG. 11 illustrates arranging a layer of material 1100 comprising a thin diffractive prism over an electronic display device 101 of a floor display system 100.

### **Audio**

[0061] Embodiments of the present invention may provide for carefully controlling the amount of sound generated by an audio device 111 of a floor display system, in particular, for example, with a view to minimizing disturbance to visitors of a commercial establishment or other public building containing a plurality of floor display systems. To this end, volume and bandwidth of sound output by the audio device may be controlled to limit how far the sound travels. For example, lower frequency sound waves (e.g., less than around 200 to 300 Hz) will travel farther with less attenuation than sound waves at higher frequencies. Thus, embodiments of the invention may comprise control

mechanisms, such as controller 103 executing suitable software, for controlling audio output to include frequencies slightly higher than around 200 to 300 Hz, and for controlling amplitude so that the audio output is optimally perceivable by a person within a predetermined range.

[0062] Embodiments may further include proximity detectors to provide signals for making determinations relating to what kind of audio output should be generated. For example, the proximity detectors could detect when a person was within a predetermined distance from a floor display system, and send corresponding signals to a controller of the floor display system. Based on the signals received from the proximity detectors, the controller could start or stop audio output, control audio frequency and volume, and the like. Controllers of respective floor display systems could also be linked to a central computer, as described above in connection with the various network configurations possible for floor display systems. The central computer could control the audio output of respective floor display systems to, for example, prevent floor display systems within a predetermined distance of each other from generating audio output simultaneously.

[0063] In embodiments, the audio device 111 could further include directional speakers, for example either incorporated into the floor covering or arranged nearby. The directional speakers could be pointed in a direction or directions in which it is expected that persons will approach. Proximity detectors could detect what direction a person is approaching from, and this information could be used by a controller to cause a corresponding directional speaker to generate audio output.

[0064] It should be understood in view of the above discussion of audio control, and of the earlier discussion of variable image orientation, that embodiments of the present invention may provide for controlling video and/or audio output based on the proximity of persons. More specifically, based on the proximity of persons, a floor display system according to embodiments of the present invention could start or stop either video or audio output, and adjust image orientation and audio output characteristics, either separately or in combination.

## **Protective Covering**

[0065] As described above, embodiments of the invention may comprise a sturdy protective cover for the electronic display device. Further implementation details, according to possible embodiments, for such a protective cover are discussed below with reference to FIGs. 12A-12B.

[0066] As shown in FIG. 12A, a protective cover 1200 may comprise a strong transparent member 1210, constructed from, by way of example only, glass or a rigid plastic. The protective cover may include a hard coating 1220 over the transparent member 1210, where the coating 1220 is, for example, a diamond-like coating, such as known hard dense carbon coatings that have mechanical properties similar to diamond, but are not as expensive. The coating 1220 could also be formed from or include plastic or polymeric coatings, such as those used to coat plastic lenses that are well known in the art. The protective cover may further include an anti-reflective coating 1230 over the hard coating 1220. The anti-reflective coating 1230 may include, for example, multiple layer or organic metal oxides or organic or polymeric coatings with various index of refraction that reduce reflection as known in the lens coating art. Though not shown, in embodiments there could be an anti-reflective coating on a bottom surface 1205 of the transparent member 1210. Coatings as described in the preceding may reduce glare and resist scratching.

[0067] FIG. 12B shows an alternative embodiment where hard coating 1220 is omitted and only an anti-reflective coating 1230 is provided on a top surface of the transparent member 1210. Again, though not shown, in embodiments there could also be an anti-reflective coating on a bottom surface 1205 of the transparent member 1210.

## **Anti-slip**

[0068] Embodiments of the present invention may further comprise a removable transparent protective sheet. The removable transparent protective sheet may include an anti-slip feature to help reduce the likelihood of a person slipping when he/she steps on the floor display system, for example due to moisture or wetness. Referring to FIG. 13A, the removable transparent protective sheet 1300 may be arranged over the protective cover 1200 described above. In addition to preventing damage to the

protective cover 1200 (e.g., soiling and scratching), the sheet 1300 may have a slip-resistant surface, where the resistance to slipping may be provided by particles such as grit or sand on or incorporated into the surface, by treads, apertures, or any other kind of discontinuity 1300.1 in the surface, by water-absorbing and/or water-dissipating materials in the sheet, or any other material properties of the sheet contributing to slip-resistance, an anti-slip coating on the surface, or any combination of the foregoing. The sheet could cover the entire floor display system, including the electronic display device and the floor covering, or could cover only portions thereof. Anti-slip material could be, for example, distributed across the floor display system in the form of strips.

[0069] As shown in FIG. 13B, embodiments could include a plurality of protective sheets in the form of a stack 1301, where sheets could be individually removable.

When a top sheet of the stack became soiled, it could be removed and discarded to expose a fresh sheet below. According to still further alternatives, an anti-slip protective sheet material could be in the form of a roll of continuous material 1302, where clean material is dispensed by, for example, a timing mechanism or a dirt-detection mechanism.

### **Fragrance Technology**

[0070] Embodiments of the present invention may comprise fragrance technology. For example, a stack of layered sheets with a scent or fragrance trapped between each sheet could be provided in a dispenser used in conjunction with a floor display system. For example, the stack of layered sheets could be arranged in a dispenser provided on or near the floor display system, for example on a stand. Alternatively, a layer of transparent scented sheets could be arranged over all or portions of a floor display system, for example on the inclined surfaces of the floor covering. Such a feature may be especially effective in the marketing of soaps, lotions, cosmetics, laundry detergents, fabric softeners, air fresheners and many other products that utilize scent or fragrance as a primary feature.

[0071] Referring to FIG. 14, in alternative embodiments, the floor display system 100 could include an electro-mechanical fragrance dispenser 1400 that releases a puff of fragrance on a periodic basis or in conjunction with a given advertisement. The



dispenser 1400 could, for example, be connected to, in or on the floor covering 102 or be otherwise associated with the floor display system. Such dispenser devices have been developed using small piezoelectric actuators to create very small pumps that spray a small amount of a stored fragrance. Also, MEMs (Microelectronic Mechanical Systems) have been developed to do electro-mechanical pumping of fluids.

### **Theft Prevention**

[0072] Embodiments of the present invention may provide for theft prevention, as discussed below.

### **Alarm System**

[0073] A floor display system according to embodiments may comprise an alarm system configured to be activated if the floor display system is moved without authorization. Referring to FIG. 15, the alarm system may comprise an unauthorized-motion detection device 1500 able to detect whether the floor display system is moved. The device 1500 could, for example, be connected to, in or on the floor covering 102 or be otherwise associated with the floor display system 100. The device could include, for example, an accelerometer or mercury switch coupled to the controller 103. Upon detecting a change in position of the floor display system, the device could send a signal to the controller. The controller might then make a determination as to whether an audible and/or visible alarm should be generated. The alarm could include, for example, emitting a siren sound or the like, and/or causing a message such as "WARNING" or "THIEF" to flash on and off on the display device. A switch or software setting could be used to deactivate the alarm system so that the floor display system could be moved without the alarm being generated.

### **Electrical Pulse**

[0074] A floor display system according to alternative embodiments may comprise an alarm system including a device able to detect whether the floor display system is moved, as described above. However, alternatively or in addition to generating an alarm, the alarm system may be configured to emit an electrical pulse if the floor display

system is moved without authorization. Accordingly, referring to FIG. 15, the floor display system 100 could include an electrical pulse generator 1501. The electrical pulse generator could, for example, be connected to, in or on the floor covering 102 or be otherwise associated with the floor display system. The electrical pulse generator 1501 could generate an electrical pulse that may cause an unauthorized handler of the floor display system to refrain from further handling of the floor display system. A switch or software setting could be used to deactivate the electrical pulse generator so that the floor display system could be moved without the pulse being generated.

### **Construction and Assembly**

[0075] FIG. 16 illustrates details of possible implementations of embodiments of the present invention. As shown in FIG. 16, a floor covering 102 of the floor display system 100 may comprise four electronic inverters 1620, 1630, 1640, 1650 for providing power for driving a back light on each of, for example, four LCD displays in a four-panel electronic display device as discussed above with reference to FIG. 3. Power may be supplied via cables 1660. A controller such as controller 103 might be constructed to be small or thin enough to be held within the borders of the floor covering 102 when other components are added to form a more complete assembly, as discussed below.

[0076] FIG. 17 is an exploded view of the floor display system 100. A base component 1710 may be configured to receive and support a wiring assembly 1720 comprising the four inverters 1620, 1630, 1640, 1650 and cables 1660 as described above. A structure 1730 may be arranged over the wiring assembly 1720; structure 1730 may be formed from plastic or other material and provide support for the inclined surfaces 212, 213, 214, 215 described above. The structure 1730 may further be configured to receive, for example in recesses formed therein, an electronic display device 101 comprising four separate panels.

[0077] Sections of surfacing material 1750, such as carpet or rubber, may be placed over structure 1730, to form inclined surfaces 212, 213, 214, 215. A plate of tempered glass including support ribs 1770 may be used as a protective covering 1200 for the electronic display device 101. Components of the floor display system may be held together, for example, with adhesive, epoxy or mechanical fasteners. A plurality of

separable protective sheets 1301 may be placed over the tempered glass 1200. The protective sheets 1301 may include anti-slip features 1300.1.

[0078] While not shown, an audio device 110 could be included in the above-described assembly. The audio device could be formed, for example, from thin profile speakers or piezoelectric speakers.

[0079] FIG. 18 shows assembled components of a floor display system 100 according to embodiments, resting on a tiled floor 1820.

[0080] Heat generated by electronics of the floor display system could be managed by potting compounds known for such purposes. The electronics could, for example, be potted and bonded to a thin metal plate that would act as a heat sink.

[0081] Embodiments of the present invention may further comprise waterproofing elements, to prevent moisture from, for example, foot traffic from damaging electronic components. Such waterproofing elements could include, for example, potting compounds used as sealants in interstices which could admit damaging moisture. For example, a potting compound could be used in spaces between the electronic display device and the floor covering to block out moisture. A water-resistant substance such as silicone could also be used for such a purpose. Further, for example, a water-resistant seal could be formed between a protective cover of the electronic display device and other surfaces of the floor display system. A sealant such as silicone could be used to form the water-resistant seal.

### **Track-and-Trench System**

[0082] Embodiments of the present invention may include a floor display system implemented as a "track-and-trench" system. The track-and-trench system may be configured to support the deployment of one or more electronic display devices in a floor.

[0083] FIG. 19A shows an illustrative example. In FIG. 19A, a trench 1910 is formed in a floor 1905. A track 1915 is arranged within the trench. Shelving 1920 may be arranged adjacent to the track and trench.

[0084] The track 1915 may include elements for supplying electric power and for transfer of electronic data. For example, electric power cabling and data transfer

cabling could be fastened to, or enclosed within, or otherwise associated with the track 1915. The power cabling and data transfer cabling could include a plurality of connections for connecting electronic devices thereto, in order for the devices to receive power and/or data via the cabling.

[0085] FIG. 19B shows an electronic display device 1925 arranged in the trench 1910. The electronic display device 1925 may be connected in some way to the track 1915: for example, it could be hooked or snapped into the track 1915. The electronic display device 1925 may include any of the display technologies and capabilities discussed above. Further, though not shown in FIG. 19B, it should be understood that the electronic display device 1925 may be associated with any of the devices discussed above, including audio devices, sensing devices, interactivity devices, network devices, and so on. More specifically, for example, the electronic display device may 1925 be coupled by wired or wireless means to a controller such as controller 103, and modifiable via the controller to display any content chosen by a user as described above. The electronic display device 1925 and corresponding controller may be connected to a power supply of the track 1915. The controller may further be coupled to a storage medium such as storage medium 104. Data may be stored in the storage medium using, for example, a data port such as data port 106 coupled to a common bus. The data port could be coupled to the data transfer cabling of the track and receive content through the cabling for storage in the storage medium and display on the electronic display device 1925 under the control of the controller. Thus, the electronic display device 1925 may be configurable to display electronically modifiable arbitrary content, support image rotation and/or translation, or otherwise include any of the capabilities discussed above in connection with an electronic display device.

[0086] As shown in FIG. 19C, space in the trench 1910 may be closed or covered by fitted sections such as sections 1930. Such fitted sections could be used to close up space in the trench not filled by an electronic display device 1925. Embodiments of the invention could further comprise a protective covering 1935 for the electronic display device. The protective covering 1935 could be transparent in its entirety, or could be partly opaque and include a transparent window 1935.1 for viewing the electronic display device.

[0087] FIG. 19D shows a cross-section along the line 19D-19D. Reference numbers 1950 and 1955 correspond to a data cable and a power cable, respectively. As can be seen in FIG. 19D, embodiments of the invention may further comprise a riser 1960 to raise the electronic display device 1925 to a desired level, and further for providing support, together with the track 1915, for the protective covering 1935.

[0088] Advantages of embodiments including a track-and-trench system as described above include that, because an electronic display device may be placed below or substantially at floor level, there is no impediment to foot or other traffic presented. Also, a shared power and data supply via a track may enable relatively economical implementations.

### **Positioning Mechanisms**

[0089] Embodiments of the present invention may relate to a floor display system including mechanisms for positioning an electronic display device associated with a floor at a selected inclination for better viewing. FIGs. 20A-20C show an illustrative example, where FIG. 20B is an orthogonal side view corresponding to FIG. 20A. According to embodiments, an electronic display device 2000 may be resting on, hingedly fastened to, or otherwise associated with a floor 2015. A positioning device 2020 may be coupled to the electronic display device 2000 to position it at a predetermined angle  $\theta$  relative to the floor 2015. This may make the electronic display device easier to see from a distance. The positioning device 2020 may, for example, comprise a spring or other flexible or expandable mechanism. As shown in FIG. 20C, the positioning device 2020 may be compressible or retractable to allow the electronic display device 2000 to be moved closer to the floor 2015 by the pressure of, for example, a person's foot 2030. An advantage of the foregoing arrangement is that an area occupied by the electronic display device may be used for foot or other traffic. It should be understood that, while not shown in FIGs. 20A-20C, the electronic display device 2000 may include any of the display technologies and capabilities discussed above, and be associated with any of the devices discussed above. Thus, the electronic display device 2000 may be configurable to display electronically modifiable

arbitrary content, support image rotation and/or translation, or otherwise include any of the capabilities discussed above in connection with an electronic display device.

[0090] FIGs. 20D-20E illustrate an alternative embodiment, where FIG. 20D is an orthogonal side view corresponding to FIG. 20A. As shown in FIGs. 20D-20E, two electronic display devices 2000, each individually configured as described with reference to FIGs. 20A-20C above, may be arranged back-to-back and share a common positioning device 2020

### **Flexible Electronic Display Device**

[0091] An electronic display device according to embodiments of the present invention could be formed from very thin, flexible, lightweight materials. An illustrative example is shown in FIGs. 21A-21C. According to embodiments, an electronic display device 2100 could comprise lightweight materials able to flex and bend as shown in FIG. 21A. More specifically, the electronic display device 2100 may include a lightweight flexible display element layer 2120 and a lightweight flexible frame 2110. The display element layer 2120 may comprise such display elements as small molecule OLEDs, polymeric OLEDs, PLEDs or LEPS. FIGs. 21B and 21C are cross-sectional views along lines 21B-21B and 21C-21C, respectively. As shown in FIG. 21B, the flexible frame 2110 may include a lightweight flexible transparent protective layer 2130 and a lightweight flexible backing layer 2160. The display element layer 2120 may be arranged between the backing layer 2160 and the transparent protective layer 2130. The transparent protective layer could comprise, for example, polycarbonate, Mylar, or other rugged transparent plastic. As shown in FIG. 21C, the electronic display device 2100 might further comprise a lightweight flexible thin film battery 2170 to power the display. The thin film battery 2170 could be arranged between the display element layer 2120 and the backing layer 2160.

[0092] The electronic display device 2100 may further comprise lightweight control electronics 2140 for driving a display of the display element layer. As shown, the control electronics 2140 may be housed with the frame 2110, laterally to the display element layer 2120. Alternatively, the control electronics could be arranged, for

example, between the display element layer 2120 and the backing layer 2160 (FIG. 21B), or between the backing layer 2160 and the thin film battery 2170 (FIG. 21C).

[0093] It should further be understood that, though not shown in FIGs. 21A-21C, the electronic display device 2100 may be associated with any of the devices discussed above, and be configurable to display electronically modifiable arbitrary content, support image rotation and/or translation, or otherwise include any of the capabilities discussed above in connection with an electronic display device.

[0094] As noted, an electronic display device 2100 as described above would very lightweight and therefore easily portable. For example, it is contemplated that the electronic display device 2100 could be rolled up and carried under one's arm like a newspaper.

[0095] Several embodiments of the present invention are specifically illustrated and/or described herein. However, it will be appreciated that modifications and variations of the present invention are covered by the above teachings and within the purview of the appended claims without departing from the spirit and intended scope of the invention.